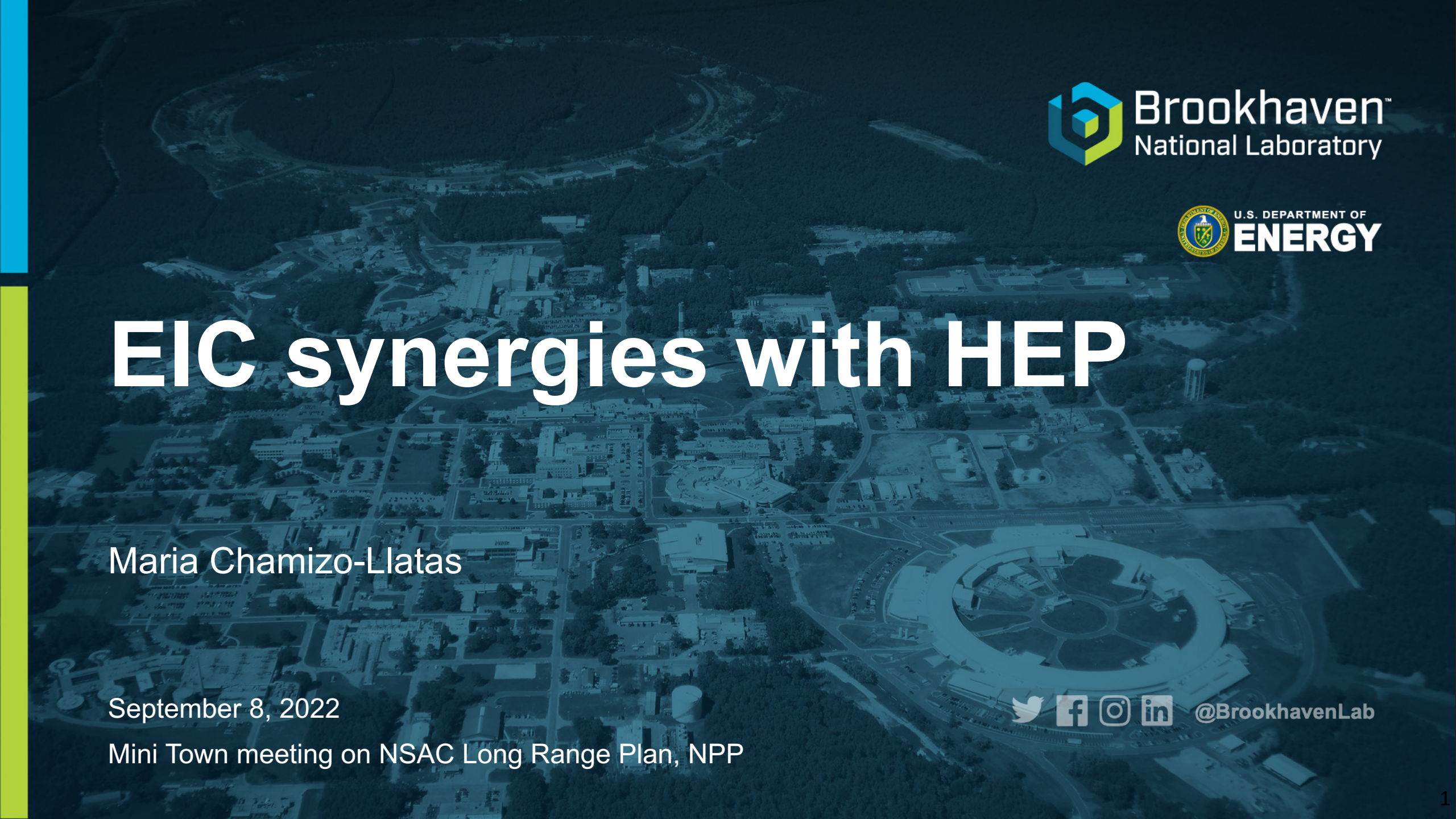


EIC synergies with HEP

Maria Chamizo-Llatas

September 8, 2022

Mini Town meeting on NSAC Long Range Plan, NPP

NP & HEP connections…Vth century BC

Fundamental question: What are the building blocks of matter?

Air

Fire

Aether?

Earth

Water

Fundamental questions

Future colliders will enable a broad range of investigations across different fields to address the fundamental questions:

- HEP: The mechanism of electroweak symmetry breaking, the origin of the masses and mixing of fundamental particles, the predominance of matter over antimatter, the nature of dark matter…
- EIC: generation of the mass and spin of the nucleons, gluon density in nuclei…

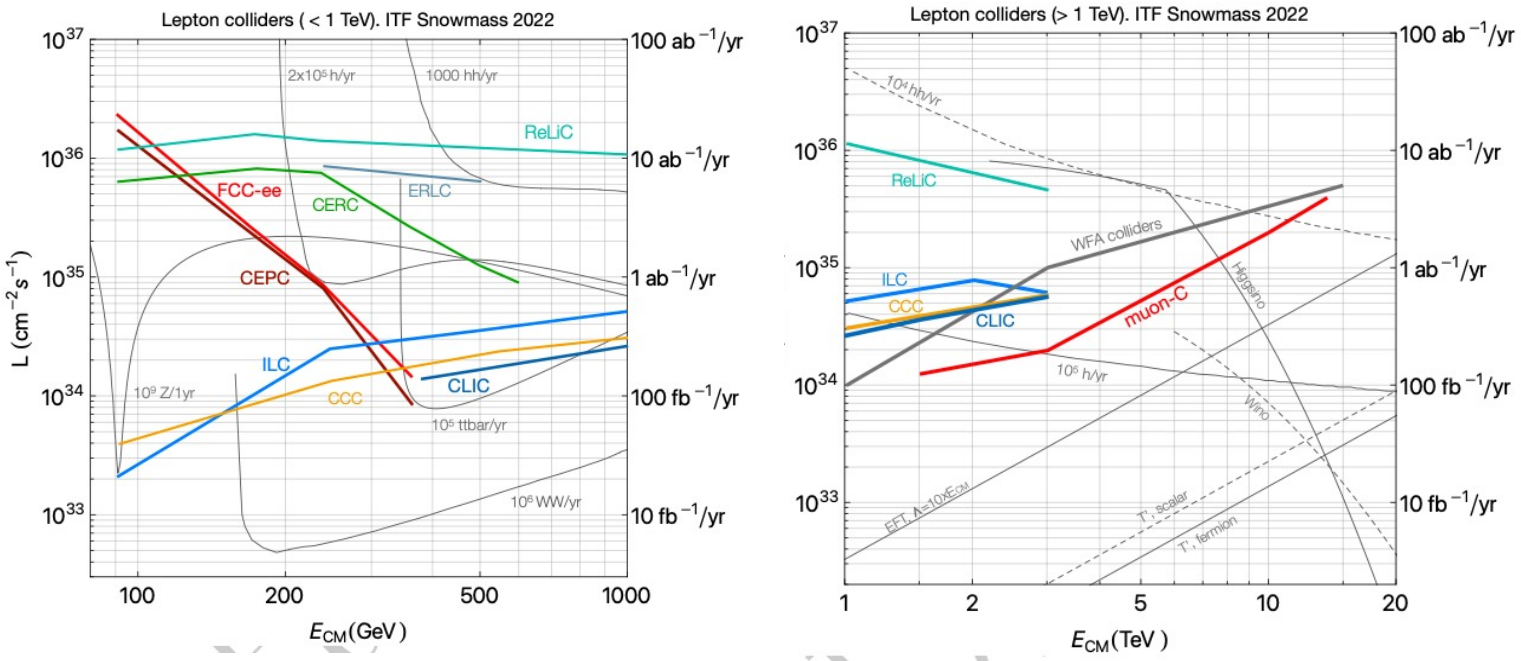
Theory improvements, accelerator and detector developments will benefit from synergies in both fields to address the fundamental questions

Opportunities for cooperation leveraging synergies in accelerator S&T, detector technologies, analysis methods, computing

EIC and HEP colliders

EIC is the only approved collider that will be built in the next decade world-wide

Collider proposals submitted to the Snowmass/P5 process (*HEP Long Range Planning Process*) shows the growing interest in the HEP community in e+e- colliders with different technologies (and different levels of maturity)



The EIC represents an opportunity to engage with the broad international scientific and accelerator communities to collaborate on realizing the EIC (reaching ultimate performance) while moving forward the state of accelerator and detector technology

e+e- collider *zoo* summarized in the Snowmass Integrated Task Force report

(some) Synergies between EIC-HEP

Accelerator

- SRF cavities, crab-waist collision scheme
- Complex super-conducting magnets
- Complex interaction regions, MDI
- Polarization
- Ultra-high vacuum systems
- ERLs
- Beam instrumentation, feedback systems
- Collimation
- Efficient RF systems
- Simulation tools
- …

Detectors

- Inner tracker with the lowest possible mass and the smallest possible inner radius
- Low-mass outer tracker for excellent momentum resolution
- Highly segmented calorimeter to support particle flow reconstruction
- Large superconducting solenoids
- Muon system (included in HEP detectors, EIC upgrades or detector 2)
- Triggerless readout
- Particle identification

Cross cutting: AI/ML, computing,

Long term benefits

Ultimate EIC performance and future HEP colliders will benefit from exchange of intellectual knowledge and development of technologies

Strengthen R&D beyond the reach of an individual community to achieve ultimate performance

Establish collaborations to enable sustainable research in fundamental physics

EIC represents an opportunity for the HEP community to maintain capabilities between current HEP colliders and future colliders